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(54) **SIX-POLE 54-SLOT FLAT WIRE MOTOR THREE-BRANCH BALANCING WINDING AND USE METHOD THEREFOR**

(57) Disclosed are a three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor and a method. A three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor includes a three-phase flat copper wire winding distributed symmetrically along a circumferential direction of an iron core slot. Spans of the welding end (1) are equal, and heights of the lead welding ends (1) are equal. The power lead wire end (3) is composed of four U-Pin wire types and one I-pin wire type, and a first layer of the power lead wire end (3) is composed of an I-Pin wire (4) and an U-pin wire (5) with an equal span. Both a second layer and a third layer are composed of U-Pin wires (6) with an equal span. Both a fourth layer and a fifth layer are composed of U-pin wires (7) with an equal span. A sixth layer is composed of a U-pin wire (8) with an equal span.

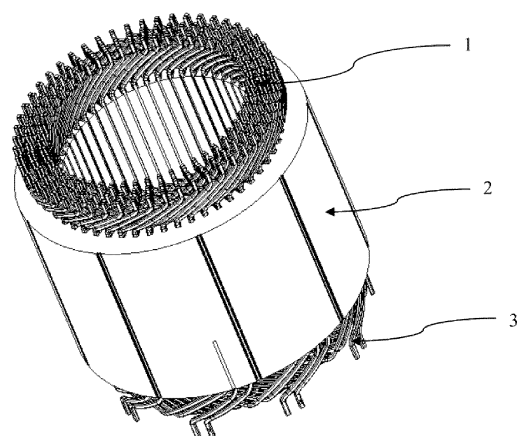


FIG. 10

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Chinese patent application No. 202211135810.9, and filed on September 19, 2022, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of components of windings of the motor distributed in slots, and in particular to a three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor, and a method.

BACKGROUND

[0003] Flat copper wire drive motors used in electric vehicles generally suffer from unbalanced current in each phase winding branch, many special-shaped wires, and poor mass production processability. As the frequency of the power supply gradually increases, due to potential imbalance between the same-phase branches, the current between the parallel branches will gradually be unevenly distributed, and there will be circulating current between the branches, which will eventually lead to uneven heating of the inner and outer armature winding branches, thereby damaging the insulation system of the motor. Flat copper wire motors have multiple parallel branches, resulting in a complex structure of bridging wires, star point wires, and power supply lead wires connected to the end of the flat copper wires, which does not meet the requirements of automated wire insertion processes.

SUMMARY

[0004] In order to overcome the shortcomings of the related art and provide a motor winding structure with compact structure and balanced current, the present application provides a three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor, and a method.

[0005] The present application achieves the purpose through the following technical solutions.

[0006] A three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor includes:

a three-phase flat copper wire winding distributed symmetrically along a circumferential direction of an iron core slot, where the three-phase flat copper wire winding includes a wire straight portion distributed in the iron core slot, a welding end distributed at one side of an end of an iron core, and a power lead wire end distributed at another side of the iron core (2); and

spans of the welding end are equal, and heights of the lead welding ends are equal; the power lead wire end is composed of four U-Pin wire types and one I-pin wire type, and a first layer of the power lead wire end is composed of an I-Pin wire and an U-pin wire with an equal span; both a second layer and a third layer are composed of U-pin wires with an equal span; both a fourth layer and a fifth layer are composed of U-pin wires with an equal span; a sixth layer is composed of a U-pin wire with an equal span; the I-Pin wire includes a U-phase power wire, a V-phase power wire, a W-phase power wire, and a star point wire when a Y-connection manner is adopted in the winding, and the U-phase power wire, the V-phase power wire, the W-phase power wire, and the star point wire are distributed at an end of the winding at the first layer of the iron core slot; no other protruding special-shaped wires and bridge wires are provided.

[0007] In the three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor, the three-phase flat copper wire winding is a six-layer winding, and each phase winding is composed of three branches connected in parallel; a connection sequence of each parallel branch is configured as follows: entering from a first layer L1 of the iron core slot; passing through a second layer L2, a third layer L3, a fourth layer L4, a fifth layer L5, and a sixth layer L6 along a forward direction in sequence; passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, the second layer L2, the first layer L1 along a reverse direction in sequence; passing through the first layer L1, the second layer L2, the third layer L3, the fourth layer L4, the fifth layer L5, and the sixth layer L6 along the forward direction; passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, the second layer L2, the first layer L1 along the reverse direction; passing through the first layer L1, the second layer L2, the third layer L3, the fourth layer L4, the fifth layer L5, and the sixth layer L6 along the forward direction; then passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, and the second layer L2 along the reverse direction; finally leading out from the first layer L1.

[0008] In the three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor, the U-phase power wire, the V-phase power wire and the W-phase of the three-phase flat copper wire winding is configured to adopt a Y-connection manner (as shown in the FIG. 7) or a delta connection manner (as shown in the FIG. 9); and

the three-phase flat copper wire winding is configured to adopt a short span with a span Y of eight, a full span with a span Y of nine, or a long span with a span Y of ten.

[0009] In the three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor, where the U-phase power wire, the V-phase power wire, the W-phase power wire, the star point wire (when the winding is configured to adopt a Y-connection manner) are evenly dis-

tributed at the end of the winding at the first layer of the iron core slot when the winding is configured to adopt a Y-connection manner.

[0010] A method of using the three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor, where the method is implemented in sequence as follows:

a branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding connection sequence is: L1 of a slot 1→L2 of a slot 9→L3 of a slot 19→L4 of a slot 27→L5 of a slot 37→L6 of a slot 45→L6 of a slot 54→L5 of a slot 46→L4 of a slot 36→L3 of a slot 28→L2 of a slot 18→L1 of a slot 10→L1 of a slot 2→L2 of a slot 10→L3 of a slot 20→L4 of a slot 28→L5 of a slot 38→L6 of a slot 46→L6 of a slot 1→L5 of a slot 47→L4 of a slot 37→L3 of a slot 29→L2 of a slot 19→L1 of a slot 11→L1 of a slot 3→L2 of a slot 11→L3 of a slot 21→L4 of a slot 29→L5 of a slot 39→L6 of a slot 47→L6 of a slot 2→L5 of a slot 48→L4 of a slot 38→L3 of a slot 30→L2 of a slot 20→L1 of a slot 12;

a branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→L2 of a slot 27→L3 of a slot 37→L4 of a slot 45→L5 of a slot 1→L6 of a slot 9→L6 of a slot 18→L5 of a slot 10→L4 of a slot 54→L3 of a slot 46→L2 of a slot 36→L1 of a slot 28→L1 of a slot 20→L2 of a slot 28→L3 of a slot 38→L4 of a slot 46→L5 of a slot 2→L6 of a slot 10→L6 of a slot 19→L5 of a slot 11→L4 of a slot 1→L3 of a slot 47→L2 of a slot 37→L1 of a slot 29→L1 of a slot 21→L2 of a slot 29→L3 of a slot 39→L4 of a slot 47→L5 of a slot 3→L6 of a slot 11→L6 of a slot 20→L5 of a slot 12→L4 of a slot 2→L3 of a slot 48→L2 of a slot 38→L1 of a slot 30;

a branch 3 of the U-phase winding, namely a first end U1 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→L2 of a slot 45→L3 of a slot 1→L4 of a slot 9→L5 of a slot 19→L6 of a slot 27→L6 of a slot 36→L5 of a slot 28→L4 of a slot 18→L3 of a slot 10→L2 of a slot 54→L1 of a slot 46→L1 of a slot 38→L2 of a slot 46→L3 of a slot 2→L4 of a slot 10→L5 of a slot 20→L6 of a slot 28→L6 of a slot 37→L5 of a slot 29→L4 of a slot 19→L3 of a slot 11→L2 of a slot 1→L1 of a slot 47→L1 of a slot 39→L2 of a slot 47→L3 of a slot 3→L4 of a slot 11→L5 of a slot 21→L6 of a slot 29→L6 of a slot 38→L5 of a slot 30→L4 of a slot 20→L3 of a slot 12→L2 of a

slot 2→L1 of a slot 48;

a branch 1 of the V-phase winding, namely a first end V1 of V1-Y1, enters from the first layer L1 of a slot 7 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 18, and the winding connection sequence is: L1 of a slot 7→L2 of a slot 15→L3 of a slot 25→L4 of a slot 33→L5 of a slot 43→L6 of a slot 51→L6 of a slot 6→L5 of a slot 52→L4 of a slot 42→L3 of a slot 34→L2 of a slot 24→L1 of a slot 16→L1 of a slot 8→L2 of a slot 16→L3 of a slot 26→L4 of a slot 34→L5 of a slot 44→L6 of a slot 52→L6 of a slot 7→L5 of a slot 53→L4 of a slot 43→L3 of a slot 35→L2 of a slot 25→L1 of a slot 17→L1 of a slot 9→L2 of a slot 17→L3 of a slot 27→L4 of a slot 35→L5 of a slot 45→L6 of a slot 53→L6 of a slot 8→L5 of a slot 54→L4 of a slot 44→L3 of a slot 36→L2 of a slot 26→L1 of a slot 18;

a branch 2 of the V-phase winding, namely a first end V2 of V2-Y2, enters from the first layer L1 of a slot 25 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 36, and the winding connection sequence is: L1 of a slot 25→L2 of a slot 33→L3 of a slot 43→L4 of a slot 51→L5 of a slot 7→L6 of a slot 15→L6 of a slot 24→L5 of a slot 16→L4 of a slot 6→L3 of a slot 52→L2 of a slot 42→L1 of a slot 34→L1 of a slot 26→L2 of a slot 34→L3 of a slot 44→L4 of a slot 52→L5 of a slot 8→L6 of a slot 16→L6 of a slot 25→L5 of a slot 17→L4 of a slot 7→L3 of a slot 53→L2 of a slot 43→L1 of a slot 35→L1 of a slot 27→L2 of a slot 35→L3 of a slot 45→L4 of a slot 53→L5 of a slot 9→L6 of a slot 17→L6 of a slot 26→L5 of a slot 18→L4 of a slot 8→L3 of a slot 54→L2 of a slot 44→L1 of a slot 36;

a branch 3 of the V-phase winding, namely a first end V3 of V3-Y3, enters from the first layer L1 of a slot 43 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 54, and the winding connection sequence is: L1 of a slot 43→L2 of a slot 51→L3 of a slot 7→L4 of a slot 15→L5 of a slot 25→L6 of a slot 33→L6 of a slot 42→L5 of a slot 34→L4 of a slot 24→L3 of a slot 16→L2 of a slot 6→L1 of a slot 52→L1 of a slot 44→L2 of a slot 52→L3 of a slot 8→L4 of a slot 16→L5 of a slot 26→L6 of a slot 34→L6 of a slot 43→L5 of a slot 35→L4 of a slot 25→L3 of a slot 17→L2 of a slot 7→L1 of a slot 53→L1 of a slot 45→L2 of a slot 53→L3 of a slot 9→L4 of a slot 17→L5 of a slot 27→L6 of a slot 35→L6 of a slot 44→L5 of a slot 36→L4 of a slot 26→L3 of a slot 18→L2 of a slot 8→L1 of a slot 54;

a branch 1 of the W-phase winding, namely a first end W1 of W1-Z1, enters from the first layer L1 of a slot 13 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 24, and the winding connection sequence is: L1 of a slot 13→L2 of a slot 21→L3 of a slot 31→L4 of a slot 39→

L5 of a slot 49→ L6 of a slot 3→ L6 of a slot 12→ L5 of a slot 4→ L4 of a slot 48→ L3 of a slot 40→ L2 of a slot 30→ L1 of a slot 22→ L1 of a slot 14→ L2 of a slot 22→ L3 of a slot 32→ L4 of a slot 40→ L5 of a slot 50→ L6 of a slot 4→ L6 of a slot 13→ L5 of a slot 5→ L4 of a slot 49→ L3 of a slot 41→ L2 of a slot 31→ L1 of a slot 23→ L1 of a slot 15→ L2 of a slot 23→ L3 of a slot 33→ L4 of a slot 41→ L5 of a slot 51→ L6 of a slot 5→ L6 of a slot 14→ L5 of a slot 6→ L4 of a slot 50→ L3 of a slot 42→ L2 of a slot 32→ L1 of a slot 24;

a branch 2 of the W-phase winding, namely a first end W1 of W2-Z2, enters from the first layer L1 of a slot 31 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 42, and the winding connection sequence is: L1 of a slot 31→ L2 of a slot 39→ L3 of a slot 49→ L4 of a slot 3→ L5 of a slot 13→ L6 of a slot 21→ L6 of a slot 30→ L5 of a slot 22→ L4 of a slot 12→ L3 of a slot 4→ L2 of a slot 48→ L1 of a slot 40→ L1 of a slot 32→ L2 of a slot 40→ L3 of a slot 50→ L4 of a slot 4→ L5 of a slot 14→ L6 of a slot 22→ L6 of a slot 31→ L5 of a slot 23→ L4 of a slot 13→ L3 of a slot 5→ L2 of a slot 49→ L1 of a slot 41→ L1 of a slot 33→ L2 of a slot 41→ L3 of a slot 51→ L4 of a slot 5→ L5 of a slot 15→ L6 of a slot 23→ L6 of a slot 32→ L5 of a slot 24→ L4 of a slot 14→ L3 of a slot 6→ L2 of a slot 50→ L1 of a slot 42;

a branch 3 of the W-phase winding, namely a first end W3 of W3-Z3, enters from the first layer L1 of a slot 49 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 6, and the winding connection sequence is: L1 of a slot 49→ L2 of a slot 3→ L3 of a slot 13→ L4 of a slot 21→ L5 of a slot 31→ L6 of a slot 39→ L6 of a slot 48→ L5 of a slot 40→ L4 of a slot 30→ L3 of a slot 22→ L2 of a slot 12→ L1 of a slot 4→ L1 of a slot 50→ L2 of a slot 4→ L3 of a slot 14→ L4 of a slot 22→ L5 of a slot 32→ L6 of a slot 40→ L6 of a slot 49→ L5 of a slot 41→ L4 of a slot 31→ L3 of a slot 23→ L2 of a slot 13→ L1 of a slot 5→ L1 of a slot 51→ L2 of a slot 5→ L3 of a slot 15→ L4 of a slot 23→ L5 of a slot 33→ L6 of a slot 41→ L6 of a slot 50→ L5 of a slot 42→ L4 of a slot 32→ L3 of a slot 24→ L2 of a slot 14→ L1 of a slot 6.

[0011] The present application has the following beneficial effects.

1. The current of the three-phase winding is balanced, and the branch current of each phase winding can be balanced, which solves the adverse effects of increased alternating current losses in the windings due to unbalanced branch currents, reduces the branch circulating current, thereby improving the efficiency of the motor.

2. Since the problem of unbalanced current in each branch is solved, the uneven temperature distribu-

tion in the inner and outer layers of the flat copper wire winding is improved, thereby improving the reliability of the entire stator insulation system.

3. The winding welding ends are provided with equal spans, equal heights, and consistent circumferential distribution, which facilitates automated mass production processes, such as cutting, twisting, and welding, thereby reducing the complexity of automated equipment, and facilitating automated mass production.

4. The entire motor winding line specifications are less, and the investment in production line equipment is small, which facilitates automated wiring. There are five wire types: two types of wires at the first layer of the iron core slot (one U-Pin wire and one I-Pin wire), one type of U-Pin wire at the second and third layers of the iron core slot, one type of U-Pin wire at the fourth and fifth layers of the iron core slot, and one type of U-Pin wire at the sixth layer of the iron core slot.

5. Both the power supply lead wire and the star point wire are located at the first layer of windings in the iron core slot (the first layer at the bottom of the slot). The yoke space at the end of the winding can be used, and the axial space layout at the end of the winding can also be used, which is beneficial to shortening the axial height at the end of the winding of the motor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a distribution diagram of a flat copper wire in the iron core slot according to the present application.

FIG. 2 is a phase diagram of a U-phase short-range winding, a V-phase short-range winding, and a W-phase short-range winding in the iron core slot according to the present application.

FIG. 3 is a connection diagram of a first branch of the U-phase winding according to the present application.

FIG. 4 is a connection diagram of a second branch of the U-phase winding according to the present application.

FIG. 5 is a connection diagram of a third branch of the U-phase winding according to the present application.

FIG. 6 is a connection diagram of the U-phase winding according to the present application.

FIG. 7 is a connection diagram of ends of a three-phase winding with the Y-connection manner according to the present application.

FIG. 8 is a connection diagram of a U-phase winding, a V-phase winding, and a W-phase winding according to the present application.

FIG. 9 is a connection diagram of ends of the three-

phase winding with the delta-connection according to the present application.

FIG. 10 is a schematic structural diagram of the welding end of three-phase winding according to the present application.

FIG. 11 is a schematic structural diagram of the lead wire end of the three-phase winding according to the present application.

[0013] The names of the components represented by the reference numbers are as follows:

1, welding end of the winding end; 2, straight portion of the wire in the iron core and the iron core slot; 3, power lead end; 4, I-pin wire and star point lead wire of the power lead wire (when adopting the Y-connection manner) at the first layer in the iron core slot; 5, U-pin wire at the first layer in the iron core slot; 6, U-pin wire at the second and third layers in the iron core slot; 7, U-pin wire at the fourth and fifth layers in the iron core slot; 8, U-pin wire at the sixth layer in the iron core slot.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0014] The present application will be further described below through specific embodiments.

First embodiment:

[0015] A three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor with a short range of $Y=8$, adopts the Y-connection manner, and a number of parallel branches is 3. The winding connection structure is as shown in FIG. 1 to FIG. 8, and the specific structure is as follows.

[0016] The winding expansion diagram shows a six-layer flat copper wire winding, that is, there are 6 flat copper wires in each slot number. The number of flat wire layers from the bottom of the slot to the opening of the slot is 1, 2, 3, 4, 5, and 6, which is as shown in FIG. 1.

[0017] As for the straight portion of the winding, the straight portion of the three-phase flat copper wire winding is evenly divided into three-phase symmetrical windings based on the short range $Y=8$, namely the U phase, the V phase and the W phase, as shown in FIG. 2.

[0018] The winding adopts the Y-connection manner, the number of parallel branches is 3, and each phase winding is composed of three branches connected in parallel, as shown in FIG. 7.

[0019] As shown in FIG. 7, the U-phase winding is composed of a branch 1 (U1-X1), a branch 2 (U2-X2) and a branch 3 (U3-X3), and the V-phase winding is composed of a branch 1 (V1-Y1), a branch 2 (V2-Y2) and a branch 3 (V3-Y3), the W-phase winding is composed of a branch 1 (W1-Z1), a branch 2 (W2-Z2) and a branch 3 (W3-Z3).

[0020] The branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding

connection sequence is: L1 of a slot 1→L2 of a slot 9→L3 of a slot 19→L4 of a slot 27→L5 of a slot 37→L6 of a slot 45→L6 of a slot 54→L5 of a slot 46→L4 of a slot 36→L3 of a slot 28→L2 of a slot 18→L1 of a slot 10→L1 of a slot 2→L2 of a slot 10→L3 of a slot 20→L4 of a slot 28→L5 of a slot 38→L6 of a slot 46→L6 of a slot 1→L5 of a slot 47→L4 of a slot 37→L3 of a slot 29→L2 of a slot 19→L1 of a slot 11→L1 of a slot 3→L2 of a slot 11→L3 of a slot 21→L4 of a slot 29→L5 of a slot 39→L6 of a slot 47→L6 of a slot 2→L5 of a slot 48→L4 of a slot 38→L3 of a slot 30→L2 of a slot 20→L1 of a slot 12. The specific connection method can be shown in FIG. 3 or FIG. 8.

[0021] The branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→L2 of a slot 27→L3 of a slot 37→L4 of a slot 45→L5 of a slot 1→L6 of a slot 9→L6 of a slot 18→L5 of a slot 10→L4 of a slot 54→L3 of a slot 46→L2 of a slot 36→L1 of a slot 28→L1 of a slot 20→L2 of a slot 28→L3 of a slot 38→L4 of a slot 46→L5 of a slot 2→L6 of a slot 10→L6 of a slot 19→L5 of a slot 11→L4 of a slot 1→L3 of a slot 47→L2 of a slot 37→L1 of a slot 29→L1 of a slot 21→L2 of a slot 29→L3 of a slot 39→L4 of a slot 47→L5 of a slot 3→L6 of a slot 11→L6 of a slot 20→L5 of a slot 12→L4 of a slot 2→L3 of a slot 48→L2 of a slot 38→L1 of a slot 30. The specific connection method can be shown in FIG. 4 or FIG. 8.

[0022] The branch 3 of the U-phase winding, namely a first end U1 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→L2 of a slot 45→L3 of a slot 1→L4 of a slot 9→L5 of a slot 19→L6 of a slot 27→L6 of a slot 36→L5 of a slot 28→L4 of a slot 18→L3 of a slot 10→L2 of a slot 54→L1 of a slot 46→L1 of a slot 38→L2 of a slot 46→L3 of a slot 2→L4 of a slot 10→L5 of a slot 20→L6 of a slot 28→L6 of a slot 37→L5 of a slot 29→L4 of a slot 19→L3 of a slot 11→L2 of a slot 1→L1 of a slot 47→L1 of a slot 39→L2 of a slot 47→L3 of a slot 3→L4 of a slot 11→L5 of a slot 21→L6 of a slot 29→L6 of a slot 38→L5 of a slot 30→L4 of a slot 20→L3 of a slot 12→L2 of a slot 2→L1 of a slot 48. The specific connection method can be shown in FIG. 5 or FIG. 8.

[0023] In the same way, the V-phase winding and U-phase winding branches are connected in the same way, except that the starting slot is different, that is, a branch 1 (V1-Y1) of the V-phase winding enters from the first layer L1 of a slot 7 of the winding along a current flow direction and finally flows out from a first layer L1 of a slot 18, a branch 2 (V2-Y2) of the V-phase winding enters from the first layer L1 of a slot 25 of the winding along a current flow direction and finally flows out from a first layer L1 of a slot 36, a branch 3 (V3-Y3) of the V-phase winding enters from the first layer L1 of a slot 43 of the

winding along a current flow direction and finally flows out from a first layer L1 of a slot 54. The detailed connection sequence of the three branches is as shown in FIG. 8.

[0024] The branch 1 of the V-phase winding, namely a first end V1 of V1-Y1, enters from the first layer L1 of a slot 7 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 18, and the winding connection sequence is: L1 of a slot 7→L2 of a slot 15→L3 of a slot 25→L4 of a slot 33→L5 of a slot 43→L6 of a slot 51→L6 of a slot 6→L5 of a slot 52→L4 of a slot 42→L3 of a slot 34→L2 of a slot 24→L1 of a slot 16→L1 of a slot 8→L2 of a slot 16→L3 of a slot 26→L4 of a slot 34→L5 of a slot 44→L6 of a slot 52→L6 of a slot 7→L5 of a slot 53→L4 of a slot 43→L3 of a slot 35→L2 of a slot 25→L1 of a slot 17→L1 of a slot 9→L2 of a slot 17→L3 of a slot 27→L4 of a slot 35→L5 of a slot 45→L6 of a slot 53→L6 of a slot 8→L5 of a slot 54→L4 of a slot 44→L3 of a slot 36→L2 of a slot 26→L1 of a slot 18. The specific connection method can be shown in FIG. 8.

[0025] The branch 2 of the V-phase winding, namely a first end V2 of V2-Y2, enters from the first layer L1 of a slot 25 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 36, and the winding connection sequence is: L1 of a slot 25→L2 of a slot 33→L3 of a slot 43→L4 of a slot 51→L5 of a slot 7→L6 of a slot 15→L6 of a slot 24→L5 of a slot 16→L4 of a slot 6→L3 of a slot 52→L2 of a slot 42→L1 of a slot 34→L1 of a slot 26→L2 of a slot 34→L3 of a slot 44→L4 of a slot 52→L5 of a slot 8→L6 of a slot 16→L6 of a slot 25→L5 of a slot 17→L4 of a slot 7→L3 of a slot 53→L2 of a slot 43→L1 of a slot 35→L1 of a slot 27→L2 of a slot 35→L3 of a slot 45→L4 of a slot 53→L5 of a slot 9→L6 of a slot 17→L6 of a slot 26→L5 of a slot 18→L4 of a slot 8→L3 of a slot 54→L2 of a slot 44→L1 of a slot 36. The specific connection method can be shown in FIG. 8.

[0026] The branch 3 of the V-phase winding, namely a first end V3 of V3-Y3, enters from the first layer L1 of a slot 43 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 54, and the winding connection sequence is: L1 of a slot 43→L2 of a slot 51→L3 of a slot 7→L4 of a slot 15→L5 of a slot 25→L6 of a slot 33→L6 of a slot 42→L5 of a slot 34→L4 of a slot 24→L3 of a slot 16→L2 of a slot 6→L1 of a slot 52→L1 of a slot 44→L2 of a slot 52→L3 of a slot 8→L4 of a slot 16→L5 of a slot 26→L6 of a slot 34→L6 of a slot 43→L5 of a slot 35→L4 of a slot 25→L3 of a slot 17→L2 of a slot 7→L1 of a slot 53→L1 of a slot 45→L2 of a slot 53→L3 of a slot 9→L4 of a slot 17→L5 of a slot 27→L6 of a slot 35→L6 of a slot 44→L5 of a slot 36→L4 of a slot 26→L3 of a slot 18→L2 of a slot 8→L1 of a slot 54. The specific connection method can be shown in FIG. 8.

[0027] In the same way, the W-phase winding and U-phase winding branches are connected in the same way, except that the starting slot is different, that is, a branch

1 (W1-Z1) enters from the first layer L1 of a slot 13 of the winding along a current flow direction and finally flows out from a first layer L1 of a slot 24, a branch 2 of the W-phase winding (W2-Z2) enters from the first layer L1 of a slot 31 of the winding along a current flow direction and finally flows out from a first layer L1 of a slot 42, a branch 3 of the W-phase winding (W3-Z3) enters from the first layer L1 of a slot 49 of the winding along a current flow direction and finally flows out from a first layer L1 of a slot 6. The detailed connection sequence of the three branches is as shown in FIG. 8.

[0028] The branch 1 of the W-phase winding, namely a first end W1 of W1-Z1, enters from the first layer L1 of a slot 13 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 24, and the winding connection sequence is: L1 of a slot 13→L2 of a slot 21→L3 of a slot 31→L4 of a slot 39→L5 of a slot 49→L6 of a slot 3→L6 of a slot 12→L5 of a slot 4→L4 of a slot 48→L3 of a slot 40→L2 of a slot 30→L1 of a slot 22→L1 of a slot 14→L2 of a slot 22→L3 of a slot 32→L4 of a slot 40→L5 of a slot 50→L6 of a slot 4→L6 of a slot 13→L5 of a slot 5→L4 of a slot 49→L3 of a slot 41→L2 of a slot 31→L1 of a slot 23→L1 of a slot 15→L2 of a slot 23→L3 of a slot 33→L4 of a slot 41→L5 of a slot 51→L6 of a slot 5→L6 of a slot 14→L5 of a slot 6→L4 of a slot 50→L3 of a slot 42→L2 of a slot 32→L1 of a slot 24. The specific connection method can be shown in FIG. 8.

[0029] The branch 2 of the W-phase winding, namely a first end W2 of W2-Z2, enters from the first layer L1 of a slot 31 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 42, and the winding connection sequence is: L1 of a slot 31→L2 of a slot 39→L3 of a slot 49→L4 of a slot 3→L5 of a slot 13→L6 of a slot 21→L6 of a slot 30→L5 of a slot 22→L4 of a slot 12→L3 of a slot 4→L2 of a slot 48→L1 of a slot 40→L1 of a slot 32→L2 of a slot 40→L3 of a slot 50→L4 of a slot 4→L5 of a slot 14→L6 of a slot 22→L6 of a slot 31→L5 of a slot 23→L4 of a slot 13→L3 of a slot 5→L2 of a slot 49→L1 of a slot 41→L1 of a slot 33→L2 of a slot 41→L3 of a slot 51→L4 of a slot 5→L5 of a slot 15→L6 of a slot 23→L6 of a slot 32→L5 of a slot 24→L4 of a slot 14→L3 of a slot 6→L2 of a slot 50→L1 of a slot 42. The specific connection method can be shown in FIG. 8.

[0030] The branch 3 of the W-phase winding, namely a first end W3 of W3-Z3, enters from the first layer L1 of a slot 49 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 6, and the winding connection sequence is: L1 of a slot 49→L2 of a slot 3→L3 of a slot 13→L4 of a slot 21→L5 of a slot 31→L6 of a slot 39→L6 of a slot 48→L5 of a slot 40→L4 of a slot 30→L3 of a slot 22→L2 of a slot 12→L1 of a slot 4→L1 of a slot 50→L2 of a slot 4→L3 of a slot 14→L4 of a slot 22→L5 of a slot 32→L6 of a slot 40→L6 of a slot 49→L5 of a slot 41→L4 of a slot 31→L3 of a slot 23→L2 of a slot 13→L1 of a slot 5→L1 of a slot 51→L2 of a slot 5→L3 of a slot 15→L4 of a slot 23→

L5 of a slot 33→L6 of a slot 41→L6 of a slot 50→L5 of a slot 42→L4 of a slot 32→L3 of a slot 24→L2 of a slot 14→L1 of a slot 6. The specific connection method can be shown in FIG. 8.

[0031] As shown in FIG. 7 and FIG. 8, the U phase (composed of U1, U2, U3), the V phase (composed of V1, V2, V3), and the W phase (composed of W1, W2, W3) of the power lead wire are distributed at the first layer of the winding. When the connection at the end of the three-phase power lead wire is arranged in this way, it can be arranged in the end axial space or the end radial space, which is conducive to flexible switching according to the installation space, especially the end axial height can be significantly reduced by utilizing the end radial space. The three star points X1-Y1-Z1, X2-Y2-Z2, and X3-Y3-Z3 are also distributed at the first layer of the winding. In this way, the arrangement can be flexibly switched between the end axial space and the end radial space according to the installation space.

Second embodiment:

[0032] A three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor with a short range of $Y=8$, adopts the delta-connection method, and a number of parallel branches is 3. The straight portion of the winding in the winding connection structure, the welding end, and the power lead wire end are exactly the same as those in the first embodiment, except that the connection method of the three-phase power wire is different and there is no star point connection. The specific connection method is as shown in FIG. 9.

[0033] The U phase of the power lead wire is composed of U1, U2, U3, Y1, Y2, Y3, the V phase is composed of V1, V2, V3, Z1, Z2, Z3, and the W phase is composed of W1, W2, W3, X1, X2, X3.

Claims

1. A three-branch balanced winding of a six-pole, fifty-four-slot flat copper wire motor, **characterized by** comprising:

a three-phase flat copper wire winding distributed symmetrically along a circumferential direction of an iron core slot, wherein the three-phase flat copper wire winding comprises a wire straight portion (2) distributed in the iron core slot, a welding end (1) distributed at one side of an end of an iron core (2), and a power lead wire end (3) distributed at another side of the iron core (2); and
spans of the welding end (1) are equal, and heights of the lead welding ends (1) are equal; the power lead wire end (3) is composed of four U-Pin wire types and one I-pin wire type, and a first layer of the power lead wire end (3) is com-

posed of an I-Pin wire (4) and an U-pin wire (5) with an equal span; both a second layer and a third layer are composed of U-pin wires (6) with an equal span; both a fourth layer and a fifth layer are composed of U-pin wires (7) with an equal span; a sixth layer is composed of a U-pin wire (8) with an equal span; the I-Pin wire (4) comprises a U-phase power wire, a V-phase power wire, a W-phase power wire, and a star point wire when a Y-connection manner is adopted in the winding, and the U-phase power wire, the V-phase power wire, the W-phase power wire, and the star point wire are distributed at an end of the winding at the first layer of the iron core slot; no other protruding special-shaped wires and bridge wires are provided.

2. The three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor according to claim 1, wherein:

the three-phase flat copper wire winding is a six-layer winding, and each phase winding is composed of three branches connected in parallel; a connection sequence of each parallel branch is configured as follows: entering from a first layer L1 of the iron core slot; passing through a second layer L2, a third layer L3, a fourth layer L4, a fifth layer L5, and a sixth layer L6 along a forward direction in sequence; passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, the second layer L2, the first layer L1 along a reverse direction in sequence; passing through the first layer L1, the second layer L2, the third layer L3, the fourth layer L4, the fifth layer L5, and the sixth layer L6 along the forward direction; passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, the second layer L2, the first layer L1 along the reverse direction; passing through the first layer L1, the second layer L2, the third layer L3, the fourth layer L4, the fifth layer L5, and the sixth layer L6 along the forward direction; then passing through the sixth layer L6, the fifth layer L5, the fourth layer L4, the third layer L3, and the second layer L2 along the reverse direction; finally leading out from the first layer L1.

3. The three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor according to claim 1 or 2, wherein:

the U-phase power wire, the V-phase power wire and the W-phase of the three-phase flat copper wire winding is configured to adopt a Y-connection manner or a delta connection manner; and the three-phase flat copper wire winding is configured to adopt a short span with a span Y of eight, a full span with a span Y of nine, or a long span with a span Y of ten.

4. The three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor according to claim 1 or 2, wherein the U-phase power wire, the V-phase power wire, the W-phase power wire, the star point wire are evenly distributed at the end of the winding at the first layer of the iron core slot when the winding is configured to adopt a Y-connection manner. 5
5. The three-branch balanced winding of the six-pole, fifty-four-slot flat copper wire motor according to claim 3, wherein the U-phase power wire, the V-phase power wire, the W-phase power wire, the star point wire are evenly distributed at the end of the winding at the first layer of the iron core slot when the winding is configured to adopt a Y-connection manner. 10 15
6. A method of using the three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor according to claim 1 or 2, wherein the method is implemented in sequence as follows: 20

a branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding connection sequence is: L1 of a slot 1→L2 of a slot 9→L3 of a slot 19→L4 of a slot 27→L5 of a slot 37→L6 of a slot 45→L6 of a slot 54→L5 of a slot 46→L4 of a slot 36→L3 of a slot 28→L2 of a slot 18→L1 of a slot 10→L1 of a slot 2→L2 of a slot 10→L3 of a slot 20→L4 of a slot 28→L5 of a slot 38→L6 of a slot 46→L6 of a slot 1→L5 of a slot 47→L4 of a slot 37→L3 of a slot 29→L2 of a slot 19→L1 of a slot 11→L1 of a slot 3→L2 of a slot 11→L3 of a slot 21→L4 of a slot 29→L5 of a slot 39→L6 of a slot 47→L6 of a slot 2→L5 of a slot 48→L4 of a slot 38→L3 of a slot 30→L2 of a slot 20→L1 of a slot 12; 25 30 35 40

a branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→L2 of a slot 27→L3 of a slot 37→L4 of a slot 45→L5 of a slot 1→L6 of a slot 9→L6 of a slot 18→L5 of a slot 10→L4 of a slot 54→L3 of a slot 46→L2 of a slot 36→L1 of a slot 28→L1 of a slot 20→L2 of a slot 28→L3 of a slot 38→L4 of a slot 46→L5 of a slot 2→L6 of a slot 10→L6 of a slot 19→L5 of a slot 11→L4 of a slot 1→L3 of a slot 47→L2 of a slot 37→L1 of a slot 29→L1 of a slot 21→L2 of a slot 29→L3 of a slot 39→L4 of a slot 47→L5 of a slot 3→L6 of a slot 11→L6 of a slot 20→L5 of a slot 12→L4 of a slot 2→L3 45 50 55

of a slot 48→L2 of a slot 38→L1 of a slot 30; a branch 3 of the U-phase winding, namely a first end U1 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→L2 of a slot 45→L3 of a slot 1→L4 of a slot 9→L5 of a slot 19→L6 of a slot 27→L6 of a slot 36→L5 of a slot 28→L4 of a slot 18→L3 of a slot 10→L2 of a slot 54→L1 of a slot 46→L1 of a slot 38→L2 of a slot 46→L3 of a slot 2→L4 of a slot 10→L5 of a slot 20→L6 of a slot 28→L6 of a slot 37→L5 of a slot 29→L4 of a slot 19→L3 of a slot 11→L2 of a slot 1→L1 of a slot 47→L1 of a slot 39→L2 of a slot 47→L3 of a slot 3→L4 of a slot 11→L5 of a slot 21→L6 of a slot 29→L6 of a slot 38→L5 of a slot 30→L4 of a slot 20→L3 of a slot 12→L2 of a slot 2→L1 of a slot 48; a branch 1 of the V-phase winding, namely a first end V1 of V1-Y1, enters from the first layer L1 of a slot 7 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 18, and the winding connection sequence is: L1 of a slot 7→L2 of a slot 15→L3 of a slot 25→L4 of a slot 33→L5 of a slot 43→L6 of a slot 51→L6 of a slot 6→L5 of a slot 52→L4 of a slot 42→L3 of a slot 34→L2 of a slot 24→L1 of a slot 16→L1 of a slot 8→L2 of a slot 16→L3 of a slot 26→L4 of a slot 34→L5 of a slot 44→L6 of a slot 52→L6 of a slot 7→L5 of a slot 53→L4 of a slot 43→L3 of a slot 35→L2 of a slot 25→L1 of a slot 17→L1 of a slot 9→L2 of a slot 17→L3 of a slot 27→L4 of a slot 35→L5 of a slot 45→L6 of a slot 53→L6 of a slot 8→L5 of a slot 54→L4 of a slot 44→L3 of a slot 36→L2 of a slot 26→L1 of a slot 18; a branch 2 of the V-phase winding, namely a first end V2 of V2-Y2, enters from the first layer L1 of a slot 25 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 36, and the winding connection sequence is: L1 of a slot 25→L2 of a slot 33→L3 of a slot 43→L4 of a slot 51→L5 of a slot 7→L6 of a slot 15→L6 of a slot 24→L5 of a slot 16→L4 of a slot 6→L3 of a slot 52→L2 of a slot 42→L1 of a slot 34→L1 of a slot 26→L2 of a slot 34→L3 of a slot 44→L4 of a slot 52→L5 of a slot 8→L6 of a slot 16→L6 of a slot 25→L5 of a slot 17→L4 of a slot 7→L3 of a slot 53→L2 of a slot 43→L1 of a slot 35→L1 of a slot 27→L2 of a slot 35→L3 of a slot 45→L4 of a slot 53→L5 of a slot 9→L6 of a slot 17→L6 of a slot 26→L5 of a slot 18→L4 of a slot 8→L3 of a slot 54→L2 of a slot 44→L1 of a slot 36; a branch 3 of the V-phase winding, namely a first end V3 of V3-Y3, enters from the first layer L1 of a slot 43 of the winding along a current

flow direction, finally flows out from a first layer L1 of a slot 54, and the winding connection sequence is: L1 of a slot 43→ L2 of a slot 51→ L3 of a slot 7→ L4 of a slot 15→ L5 of a slot 25→ L6 of a slot 33→ L6 of a slot 42→ L5 of a slot 34→ L4 of a slot 24→ L3 of a slot 16→ L2 of a slot 6→ L1 of a slot 52→ L1 of a slot 44→ L2 of a slot 52→ L3 of a slot 8→ L4 of a slot 16→ L5 of a slot 26→ L6 of a slot 34→ L6 of a slot 43→ L5 of a slot 35→ L4 of a slot 25→ L3 of a slot 17→ L2 of a slot 7→ L1 of a slot 53→ L1 of a slot 45→ L2 of a slot 53→ L3 of a slot 9→ L4 of a slot 17→ L5 of a slot 27→ L6 of a slot 35→ L6 of a slot 44→ L5 of a slot 36→ L4 of a slot 26→ L3 of a slot 18→ L2 of a slot 8→ L1 of a slot 54; a branch 1 of the W-phase winding, namely a first end W1 of W1-Z1, enters from the first layer L1 of a slot 13 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 24, and the winding connection sequence is: L1 of a slot 13→ L2 of a slot 21→ L3 of a slot 31→ L4 of a slot 39→ L5 of a slot 49→ L6 of a slot 3→ L6 of a slot 12→ L5 of a slot 4→ L4 of a slot 48→ L3 of a slot 40→ L2 of a slot 30→ L1 of a slot 22→ L1 of a slot 14→ L2 of a slot 22→ L3 of a slot 32→ L4 of a slot 40→ L5 of a slot 50→ L6 of a slot 4→ L6 of a slot 13→ L5 of a slot 5→ L4 of a slot 49→ L3 of a slot 41→ L2 of a slot 31→ L1 of a slot 23→ L1 of a slot 15→ L2 of a slot 23→ L3 of a slot 33→ L4 of a slot 41→ L5 of a slot 51→ L6 of a slot 5→ L6 of a slot 14→ L5 of a slot 6→ L4 of a slot 50→ L3 of a slot 42→ L2 of a slot 32→ L1 of a slot 24; a branch 2 of the W-phase winding, namely a first end W1 of W2-Z2, enters from the first layer L1 of a slot 31 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 42, and the winding connection sequence is: L1 of a slot 31→ L2 of a slot 39→ L3 of a slot 49→ L4 of a slot 3→ L5 of a slot 13→ L6 of a slot 21→ L6 of a slot 30→ L5 of a slot 22→ L4 of a slot 12→ L3 of a slot 4→ L2 of a slot 48→ L1 of a slot 40→ L1 of a slot 32→ L2 of a slot 40→ L3 of a slot 50→ L4 of a slot 4→ L5 of a slot 14→ L6 of a slot 22→ L6 of a slot 31→ L5 of a slot 23→ L4 of a slot 13→ L3 of a slot 5→ L2 of a slot 49→ L1 of a slot 41→ L1 of a slot 33→ L2 of a slot 41→ L3 of a slot 51→ L4 of a slot 5→ L5 of a slot 15→ L6 of a slot 23→ L6 of a slot 32→ L5 of a slot 24→ L4 of a slot 14→ L3 of a slot 6→ L2 of a slot 50→ L1 of a slot 42; a branch 3 of the W-phase winding, namely a first end W3 of W3-Z3, enters from the first layer L1 of a slot 49 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 6, and the winding connection sequence is: L1 of a slot 49→ L2 of a slot 3→ L3

of a slot 13→ L4 of a slot 21→ L5 of a slot 31→ L6 of a slot 39→ L6 of a slot 48→ L5 of a slot 40→ L4 of a slot 30→ L3 of a slot 22→ L2 of a slot 12→ L1 of a slot 4→ L1 of a slot 50→ L2 of a slot 4→ L3 of a slot 14→ L4 of a slot 22→ L5 of a slot 32→ L6 of a slot 40→ L6 of a slot 49→ L5 of a slot 41→ L4 of a slot 31→ L3 of a slot 23→ L2 of a slot 13→ L1 of a slot 5→ L1 of a slot 51→ L2 of a slot 5→ L3 of a slot 15→ L4 of a slot 23→ L5 of a slot 33→ L6 of a slot 41→ L6 of a slot 50→ L5 of a slot 42→ L4 of a slot 32→ L3 of a slot 24→ L2 of a slot 14→ L1 of a slot 6.

7. The method of using the three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor according to claim 3, wherein the method is implemented in sequence as follows:

a branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding connection sequence is: L1 of a slot 1→ L2 of a slot 9→ L3 of a slot 19→ L4 of a slot 27→ L5 of a slot 37→ L6 of a slot 45→ L6 of a slot 54→ L5 of a slot 46→ L4 of a slot 36→ L3 of a slot 28→ L2 of a slot 18→ L1 of a slot 10→ L1 of a slot 2→ L2 of a slot 10→ L3 of a slot 20→ L4 of a slot 28→ L5 of a slot 38→ L6 of a slot 46→ L6 of a slot 1→ L5 of a slot 47→ L4 of a slot 37→ L3 of a slot 29→ L2 of a slot 19→ L1 of a slot 11→ L1 of a slot 3→ L2 of a slot 11→ L3 of a slot 21→ L4 of a slot 29→ L5 of a slot 39→ L6 of a slot 47→ L6 of a slot 2→ L5 of a slot 48→ L4 of a slot 38→ L3 of a slot 30→ L2 of a slot 20→ L1 of a slot 12; a branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→ L2 of a slot 27→ L3 of a slot 37→ L4 of a slot 45→ L5 of a slot 1→ L6 of a slot 9→ L6 of a slot 18→ L5 of a slot 10→ L4 of a slot 54→ L3 of a slot 46→ L2 of a slot 36→ L1 of a slot 28→ L1 of a slot 20→ L2 of a slot 28→ L3 of a slot 38→ L4 of a slot 46→ L5 of a slot 2→ L6 of a slot 10→ L6 of a slot 19→ L5 of a slot 11→ L4 of a slot 1→ L3 of a slot 47→ L2 of a slot 37→ L1 of a slot 29→ L1 of a slot 21→ L2 of a slot 29→ L3 of a slot 39→ L4 of a slot 47→ L5 of a slot 3→ L6 of a slot 11→ L6 of a slot 20→ L5 of a slot 12→ L4 of a slot 2→ L3 of a slot 48→ L2 of a slot 38→ L1 of a slot 30; a branch 3 of the U-phase winding, namely a first end U1 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer

L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→L2 of a slot 45→L3 of a slot 1→L4 of a slot 9→L5 of a slot 19→L6 of a slot 27→L6 of a slot 36→L5 of a slot 28→L4 of a slot 18→L3 of a slot 10→L2 of a slot 54→L1 of a slot 46→L1 of a slot 38→L2 of a slot 46→L3 of a slot 2→L4 of a slot 10→L5 of a slot 20→L6 of a slot 28→L6 of a slot 37→L5 of a slot 29→L4 of a slot 19→L3 of a slot 11→L2 of a slot 1→L1 of a slot 47→L1 of a slot 39→L2 of a slot 47→L3 of a slot 3→L4 of a slot 11→L5 of a slot 21→L6 of a slot 29→L6 of a slot 38→L5 of a slot 30→L4 of a slot 20→L3 of a slot 12→L2 of a slot 2→L1 of a slot 48;
 a branch 1 of the V-phase winding, namely a first end V1 of V1-Y1, enters from the first layer L1 of a slot 7 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 18, and the winding connection sequence is: L1 of a slot 7→L2 of a slot 15→L3 of a slot 25→L4 of a slot 33→L5 of a slot 43→L6 of a slot 51→L6 of a slot 6→L5 of a slot 52→L4 of a slot 42→L3 of a slot 34→L2 of a slot 24→L1 of a slot 16→L1 of a slot 8→L2 of a slot 16→L3 of a slot 26→L4 of a slot 34→L5 of a slot 44→L6 of a slot 52→L6 of a slot 7→L5 of a slot 53→L4 of a slot 43→L3 of a slot 35→L2 of a slot 25→L1 of a slot 17→L1 of a slot 9→L2 of a slot 17→L3 of a slot 27→L4 of a slot 35→L5 of a slot 45→L6 of a slot 53→L6 of a slot 8→L5 of a slot 54→L4 of a slot 44→L3 of a slot 36→L2 of a slot 26→L1 of a slot 18;
 a branch 2 of the V-phase winding, namely a first end V2 of V2-Y2, enters from the first layer L1 of a slot 25 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 36, and the winding connection sequence is: L1 of a slot 25→L2 of a slot 33→L3 of a slot 43→L4 of a slot 51→L5 of a slot 7→L6 of a slot 15→L6 of a slot 24→L5 of a slot 16→L4 of a slot 6→L3 of a slot 52→L2 of a slot 42→L1 of a slot 34→L1 of a slot 26→L2 of a slot 34→L3 of a slot 44→L4 of a slot 52→L5 of a slot 8→L6 of a slot 16→L6 of a slot 25→L5 of a slot 17→L4 of a slot 7→L3 of a slot 53→L2 of a slot 43→L1 of a slot 35→L1 of a slot 27→L2 of a slot 35→L3 of a slot 45→L4 of a slot 53→L5 of a slot 9→L6 of a slot 17→L6 of a slot 26→L5 of a slot 18→L4 of a slot 8→L3 of a slot 54→L2 of a slot 44→L1 of a slot 36;
 a branch 3 of the V-phase winding, namely a first end V3 of V3-Y3, enters from the first layer L1 of a slot 43 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 54, and the winding connection sequence is: L1 of a slot 43→L2 of a slot 51→L3 of a slot 7→L4 of a slot 15→L5 of a slot 25→L6 of a slot 33→L6 of a slot 42→L5 of a slot

34→L4 of a slot 24→L3 of a slot 16→L2 of a slot 6→L1 of a slot 52→L1 of a slot 44→L2 of a slot 52→L3 of a slot 8→L4 of a slot 16→L5 of a slot 26→L6 of a slot 34→L6 of a slot 43→L5 of a slot 35→L4 of a slot 25→L3 of a slot 17→L2 of a slot 7→L1 of a slot 53→L1 of a slot 45→L2 of a slot 53→L3 of a slot 9→L4 of a slot 17→L5 of a slot 27→L6 of a slot 35→L6 of a slot 44→L5 of a slot 36→L4 of a slot 26→L3 of a slot 18→L2 of a slot 8→L1 of a slot 54;
 a branch 1 of the W-phase winding, namely a first end W1 of W1-Z1, enters from the first layer L1 of a slot 13 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 24, and the winding connection sequence is: L1 of a slot 13→L2 of a slot 21→L3 of a slot 31→L4 of a slot 39→L5 of a slot 49→L6 of a slot 3→L6 of a slot 12→L5 of a slot 4→L4 of a slot 48→L3 of a slot 40→L2 of a slot 30→L1 of a slot 22→L1 of a slot 14→L2 of a slot 22→L3 of a slot 32→L4 of a slot 40→L5 of a slot 50→L6 of a slot 4→L6 of a slot 13→L5 of a slot 5→L4 of a slot 49→L3 of a slot 41→L2 of a slot 31→L1 of a slot 23→L1 of a slot 15→L2 of a slot 23→L3 of a slot 33→L4 of a slot 41→L5 of a slot 51→L6 of a slot 5→L6 of a slot 14→L5 of a slot 6→L4 of a slot 50→L3 of a slot 42→L2 of a slot 32→L1 of a slot 24;
 a branch 2 of the W-phase winding, namely a first end W2 of W2-Z2, enters from the first layer L1 of a slot 31 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 42, and the winding connection sequence is: L1 of a slot 31→L2 of a slot 39→L3 of a slot 49→L4 of a slot 3→L5 of a slot 13→L6 of a slot 21→L6 of a slot 30→L5 of a slot 22→L4 of a slot 12→L3 of a slot 4→L2 of a slot 48→L1 of a slot 40→L1 of a slot 32→L2 of a slot 40→L3 of a slot 50→L4 of a slot 4→L5 of a slot 14→L6 of a slot 22→L6 of a slot 31→L5 of a slot 23→L4 of a slot 13→L3 of a slot 5→L2 of a slot 49→L1 of a slot 41→L1 of a slot 33→L2 of a slot 41→L3 of a slot 51→L4 of a slot 5→L5 of a slot 15→L6 of a slot 23→L6 of a slot 32→L5 of a slot 24→L4 of a slot 14→L3 of a slot 6→L2 of a slot 50→L1 of a slot 42;
 a branch 3 of the W-phase winding, namely a first end W3 of W3-Z3, enters from the first layer L1 of a slot 49 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 6, and the winding connection sequence is: L1 of a slot 49→L2 of a slot 3→L3 of a slot 13→L4 of a slot 21→L5 of a slot 31→L6 of a slot 39→L6 of a slot 48→L5 of a slot 40→L4 of a slot 30→L3 of a slot 22→L2 of a slot 12→L1 of a slot 4→L1 of a slot 50→L2 of a slot 4→L3 of a slot 14→L4 of a slot 22→L5

of a slot 32→ L6 of a slot 40→ L6 of a slot 49→
L5 of a slot 41→ L4 of a slot 31→ L3 of a slot
23→ L2 of a slot 13→ L1 of a slot 5→ L1 of a
slot 51→ L2 of a slot 5→ L3 of a slot 15→ L4 of
a slot 23→ L5 of a slot 33→ L6 of a slot 41→ L6
of a slot 50→ L5 of a slot 42→ L4 of a slot 32→
L3 of a slot 24→ L2 of a slot 14→ L1 of a slot 6.

8. The method of using the three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor according to claim 4, wherein the method is implemented in sequence as follows:

a branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding connection sequence is: L1 of a slot 1→ L2 of a slot 9→ L3 of a slot 19→ L4 of a slot 27→ L5 of a slot 37→ L6 of a slot 45→ L6 of a slot 54→ L5 of a slot 46→ L4 of a slot 36→ L3 of a slot 28→ L2 of a slot 18→ L1 of a slot 10→ L1 of a slot 2→ L2 of a slot 10→ L3 of a slot 20→ L4 of a slot 28→ L5 of a slot 38→ L6 of a slot 46→ L6 of a slot 1→ L5 of a slot 47→ L4 of a slot 37→ L3 of a slot 29→ L2 of a slot 19→ L1 of a slot 11→ L1 of a slot 3→ L2 of a slot 11→ L3 of a slot 21→ L4 of a slot 29→ L5 of a slot 39→ L6 of a slot 47→ L6 of a slot 2→ L5 of a slot 48→ L4 of a slot 38→ L3 of a slot 30→ L2 of a slot 20→ L1 of a slot 12;
a branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→ L2 of a slot 27→ L3 of a slot 37→ L4 of a slot 45→ L5 of a slot 1→ L6 of a slot 9→ L6 of a slot 18→ L5 of a slot 10→ L4 of a slot 54→ L3 of a slot 46→ L2 of a slot 36→ L1 of a slot 28→ L1 of a slot 20→ L2 of a slot 28→ L3 of a slot 38→ L4 of a slot 46→ L5 of a slot 2→ L6 of a slot 10→ L6 of a slot 19→ L5 of a slot 11→ L4 of a slot 1→ L3 of a slot 47→ L2 of a slot 37→ L1 of a slot 29→ L1 of a slot 21→ L2 of a slot 29→ L3 of a slot 39→ L4 of a slot 47→ L5 of a slot 3→ L6 of a slot 11→ L6 of a slot 20→ L5 of a slot 12→ L4 of a slot 2→ L3 of a slot 48→ L2 of a slot 38→ L1 of a slot 30;
a branch 3 of the U-phase winding, namely a first end U1 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→ L2 of a slot 45→ L3 of a slot 1→ L4 of a slot 9→ L5 of a slot 19→ L6 of a slot 27→ L6 of a slot 36→ L5 of a slot 28→ L4 of a slot 18→ L3 of a slot 10→ L2 of a slot

54→ L1 of a slot 46→ L1 of a slot 38→ L2 of a slot 46→ L3 of a slot 2→ L4 of a slot 10→ L5 of a slot 20→ L6 of a slot 28→ L6 of a slot 37→ L5 of a slot 29→ L4 of a slot 19→ L3 of a slot 11→ L2 of a slot 1→ L1 of a slot 47→ L1 of a slot 39→ L2 of a slot 47→ L3 of a slot 3→ L4 of a slot 11→ L5 of a slot 21→ L6 of a slot 29→ L6 of a slot 38→ L5 of a slot 30→ L4 of a slot 20→ L3 of a slot 12→ L2 of a slot 2→ L1 of a slot 48;
a branch 1 of the V-phase winding, namely a first end V1 of V1-Y1, enters from the first layer L1 of a slot 7 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 18, and the winding connection sequence is: L1 of a slot 7→ L2 of a slot 15→ L3 of a slot 25→ L4 of a slot 33→ L5 of a slot 43→ L6 of a slot 51→ L6 of a slot 6→ L5 of a slot 52→ L4 of a slot 42→ L3 of a slot 34→ L2 of a slot 24→ L1 of a slot 16→ L1 of a slot 8→ L2 of a slot 16→ L3 of a slot 26→ L4 of a slot 34→ L5 of a slot 44→ L6 of a slot 52→ L6 of a slot 7→ L5 of a slot 53→ L4 of a slot 43→ L3 of a slot 35→ L2 of a slot 25→ L1 of a slot 17→ L1 of a slot 9→ L2 of a slot 17→ L3 of a slot 27→ L4 of a slot 35→ L5 of a slot 45→ L6 of a slot 53→ L6 of a slot 8→ L5 of a slot 54→ L4 of a slot 44→ L3 of a slot 36→ L2 of a slot 26→ L1 of a slot 18;
a branch 2 of the V-phase winding, namely a first end V2 of V2-Y2, enters from the first layer L1 of a slot 25 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 36, and the winding connection sequence is: L1 of a slot 25→ L2 of a slot 33→ L3 of a slot 43→ L4 of a slot 51→ L5 of a slot 7→ L6 of a slot 15→ L6 of a slot 24→ L5 of a slot 16→ L4 of a slot 6→ L3 of a slot 52→ L2 of a slot 42→ L1 of a slot 34→ L1 of a slot 26→ L2 of a slot 34→ L3 of a slot 44→ L4 of a slot 52→ L5 of a slot 8→ L6 of a slot 16→ L6 of a slot 25→ L5 of a slot 17→ L4 of a slot 7→ L3 of a slot 53→ L2 of a slot 43→ L1 of a slot 35→ L1 of a slot 27→ L2 of a slot 35→ L3 of a slot 45→ L4 of a slot 53→ L5 of a slot 9→ L6 of a slot 17→ L6 of a slot 26→ L5 of a slot 18→ L4 of a slot 8→ L3 of a slot 54→ L2 of a slot 44→ L1 of a slot 36;
a branch 3 of the V-phase winding, namely a first end V3 of V3-Y3, enters from the first layer L1 of a slot 43 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 54, and the winding connection sequence is: L1 of a slot 43→ L2 of a slot 51→ L3 of a slot 7→ L4 of a slot 15→ L5 of a slot 25→ L6 of a slot 33→ L6 of a slot 42→ L5 of a slot 34→ L4 of a slot 24→ L3 of a slot 16→ L2 of a slot 6→ L1 of a slot 52→ L1 of a slot 44→ L2 of a slot 52→ L3 of a slot 8→ L4 of a slot 16→ L5 of a slot 26→ L6 of a slot 34→ L6 of a slot 43→ L5 of a slot 35→ L4 of a slot 25→ L3 of a slot

17→ L2 of a slot 7→ L1 of a slot 53→ L1 of a slot 45→ L2 of a slot 53→ L3 of a slot 9→ L4 of a slot 17→ L5 of a slot 27→ L6 of a slot 35→ L6 of a slot 44→ L5 of a slot 36→ L4 of a slot 26→ L3 of a slot 18→ L2 of a slot 8→ L1 of a slot 54; a branch 1 of the W-phase winding, namely a first end W1 of W1-Z1, enters from the first layer L1 of a slot 13 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 24, and the winding connection sequence is: L1 of a slot 13→ L2 of a slot 21→ L3 of a slot 31→ L4 of a slot 39→ L5 of a slot 49→ L6 of a slot 3→ L6 of a slot 12→ L5 of a slot 4→ L4 of a slot 48→ L3 of a slot 40→ L2 of a slot 30→ L1 of a slot 22→ L1 of a slot 14→ L2 of a slot 22→ L3 of a slot 32→ L4 of a slot 40→ L5 of a slot 50→ L6 of a slot 4→ L6 of a slot 13→ L5 of a slot 5→ L4 of a slot 49→ L3 of a slot 41→ L2 of a slot 31→ L1 of a slot 23→ L1 of a slot 15→ L2 of a slot 23→ L3 of a slot 33→ L4 of a slot 41→ L5 of a slot 51→ L6 of a slot 5→ L6 of a slot 14→ L5 of a slot 6→ L4 of a slot 50→ L3 of a slot 42→ L2 of a slot 32→ L1 of a slot 24; a branch 2 of the W-phase winding, namely a first end W2 of W2-Z2, enters from the first layer L1 of a slot 31 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 42, and the winding connection sequence is: L1 of a slot 31→ L2 of a slot 39→ L3 of a slot 49→ L4 of a slot 3→ L5 of a slot 13→ L6 of a slot 21→ L6 of a slot 30→ L5 of a slot 22→ L4 of a slot 12→ L3 of a slot 4→ L2 of a slot 48→ L1 of a slot 40→ L1 of a slot 32→ L2 of a slot 40→ L3 of a slot 50→ L4 of a slot 4→ L5 of a slot 14→ L6 of a slot 22→ L6 of a slot 31→ L5 of a slot 23→ L4 of a slot 13→ L3 of a slot 5→ L2 of a slot 49→ L1 of a slot 41→ L1 of a slot 33→ L2 of a slot 41→ L3 of a slot 51→ L4 of a slot 5→ L5 of a slot 15→ L6 of a slot 23→ L6 of a slot 32→ L5 of a slot 24→ L4 of a slot 14→ L3 of a slot 6→ L2 of a slot 50→ L1 of a slot 42; a branch 3 of the W-phase winding, namely a first end W3 of W3-Z3, enters from the first layer L1 of a slot 49 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 6, and the winding connection sequence is: L1 of a slot 49→ L2 of a slot 3→ L3 of a slot 13→ L4 of a slot 21→ L5 of a slot 31→ L6 of a slot 39→ L6 of a slot 48→ L5 of a slot 40→ L4 of a slot 30→ L3 of a slot 22→ L2 of a slot 12→ L1 of a slot 4→ L1 of a slot 50→ L2 of a slot 4→ L3 of a slot 14→ L4 of a slot 22→ L5 of a slot 32→ L6 of a slot 40→ L6 of a slot 49→ L5 of a slot 41→ L4 of a slot 31→ L3 of a slot 23→ L2 of a slot 13→ L1 of a slot 5→ L1 of a slot 51→ L2 of a slot 5→ L3 of a slot 15→ L4 of a slot 23→ L5 of a slot 33→ L6 of a slot 41→ L6

of a slot 50→ L5 of a slot 42→ L4 of a slot 32→ L3 of a slot 24→ L2 of a slot 14→ L1 of a slot 6.

9. The method of using the three-branch balanced winding of the six-pole fifty-four-slot flat copper wire motor according to claim 5, wherein the method is implemented in sequence as follows:

a branch 1 of the U-phase winding, namely a first end U1 of U1-X1, enters from the first layer L1 of a slot 1 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 12, and the winding connection sequence is: L1 of a slot 1→ L2 of a slot 9→ L3 of a slot 19→ L4 of a slot 27→ L5 of a slot 37→ L6 of a slot 45→ L6 of a slot 54→ L5 of a slot 46→ L4 of a slot 36→ L3 of a slot 28→ L2 of a slot 18→ L1 of a slot 10→ L1 of a slot 2→ L2 of a slot 10→ L3 of a slot 20→ L4 of a slot 28→ L5 of a slot 38→ L6 of a slot 46→ L6 of a slot 1→ L5 of a slot 47→ L4 of a slot 37→ L3 of a slot 29→ L2 of a slot 19→ L1 of a slot 11→ L1 of a slot 3→ L2 of a slot 11→ L3 of a slot 21→ L4 of a slot 29→ L5 of a slot 39→ L6 of a slot 47→ L6 of a slot 2→ L5 of a slot 48→ L4 of a slot 38→ L3 of a slot 30→ L2 of a slot 20→ L1 of a slot 12; a branch 2 of the U-phase winding, namely a first end U2 of U2-X2, enters from the first layer L1 of a slot 19 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 30, and the winding connection sequence is: L1 of a slot 19→ L2 of a slot 27→ L3 of a slot 37→ L4 of a slot 45→ L5 of a slot 1→ L6 of a slot 9→ L6 of a slot 18→ L5 of a slot 10→ L4 of a slot 54→ L3 of a slot 46→ L2 of a slot 36→ L1 of a slot 28→ L1 of a slot 20→ L2 of a slot 28→ L3 of a slot 38→ L4 of a slot 46→ L5 of a slot 2→ L6 of a slot 10→ L6 of a slot 19→ L5 of a slot 11→ L4 of a slot 1→ L3 of a slot 47→ L2 of a slot 37→ L1 of a slot 29→ L1 of a slot 21→ L2 of a slot 29→ L3 of a slot 39→ L4 of a slot 47→ L5 of a slot 3→ L6 of a slot 11→ L6 of a slot 20→ L5 of a slot 12→ L4 of a slot 2→ L3 of a slot 48→ L2 of a slot 38→ L1 of a slot 30; a branch 3 of the U-phase winding, namely a first end U3 of U3-X3, enters from the first layer L1 of a slot 37 of the winding along a current flow direction, finally flows out from a first layer L1 of a slot 48, and the winding connection sequence is: L1 of a slot 37→ L2 of a slot 45→ L3 of a slot 1→ L4 of a slot 9→ L5 of a slot 19→ L6 of a slot 27→ L6 of a slot 36→ L5 of a slot 28→ L4 of a slot 18→ L3 of a slot 10→ L2 of a slot 54→ L1 of a slot 46→ L1 of a slot 38→ L2 of a slot 46→ L3 of a slot 2→ L4 of a slot 10→ L5 of a slot 20→ L6 of a slot 28→ L6 of a slot 37→ L5 of a slot 29→ L4 of a slot 19→ L3 of a slot 11→ L2 of a slot 1→ L1 of a slot 47→ L1 of a slot 39→

L2 of a slot 47→L3 of a slot 3→L4 of a slot 11→
 L5 of a slot 21→L6 of a slot 29→L6 of a slot
 38→L5 of a slot 30→L4 of a slot 20→L3 of a
 slot 12→L2 of a slot 2→L1 of a slot 48;
 a branch 1 of the V-phase winding, namely a
 first end V1 of V1-Y1, enters from the first layer
 L1 of a slot 7 of the winding along a current flow
 direction, finally flows out from a first layer L1 of
 a slot 18, and the winding connection sequence
 is: L1 of a slot 7→L2 of a slot 15→L3 of a slot
 25→L4 of a slot 33→L5 of a slot 43→L6 of a
 slot 51→L6 of a slot 6→L5 of a slot 52→L4 of
 a slot 42→L3 of a slot 34→L2 of a slot 24→L1
 of a slot 16→L1 of a slot 8→L2 of a slot 16→
 L3 of a slot 26→L4 of a slot 34→L5 of a slot
 44→L6 of a slot 52→L6 of a slot 7→L5 of a
 slot 53→L4 of a slot 43→L3 of a slot 35→L2
 of a slot 25→L1 of a slot 17→L1 of a slot 9→
 L2 of a slot 17→L3 of a slot 27→L4 of a slot
 35→L5 of a slot 45→L6 of a slot 53→L6 of a
 slot 8→L5 of a slot 54→L4 of a slot 44→L3 of
 a slot 36→L2 of a slot 26→L1 of a slot 18;
 a branch 2 of the V-phase winding, namely a
 first end V2 of V2-Y2, enters from the first layer
 L1 of a slot 25 of the winding along a current
 flow direction, finally flows out from a first layer
 L1 of a slot 36, and the winding connection se-
 quence is: L1 of a slot 25→L2 of a slot 33→L3
 of a slot 43→L4 of a slot 51→L5 of a slot 7→
 L6 of a slot 15→L6 of a slot 24→L5 of a slot
 16→L4 of a slot 6→L3 of a slot 52→L2 of a
 slot 42→L1 of a slot 34→L1 of a slot 26→L2
 of a slot 34→L3 of a slot 44→L4 of a slot 52→
 L5 of a slot 8→L6 of a slot 16→L6 of a slot 25→
 L5 of a slot 17→L4 of a slot 7→L3 of a slot 53→
 L2 of a slot 43→L1 of a slot 35→L1 of a slot
 27→L2 of a slot 35→L3 of a slot 45→L4 of a
 slot 53→L5 of a slot 9→L6 of a slot 17→L6 of
 a slot 26→L5 of a slot 18→L4 of a slot 8→L3
 of a slot 54→L2 of a slot 44→L1 of a slot 36;
 a branch 3 of the V-phase winding, namely a
 first end V3 of V3-Y3, enters from the first layer
 L1 of a slot 43 of the winding along a current
 flow direction, finally flows out from a first layer
 L1 of a slot 54, and the winding connection se-
 quence is: L1 of a slot 43→L2 of a slot 51→L3
 of a slot 7→L4 of a slot 15→L5 of a slot 25→
 L6 of a slot 33→L6 of a slot 42→L5 of a slot
 34→L4 of a slot 24→L3 of a slot 16→L2 of a
 slot 6→L1 of a slot 52→L1 of a slot 44→L2 of
 a slot 52→L3 of a slot 8→L4 of a slot 16→L5
 of a slot 26→L6 of a slot 34→L6 of a slot 43→
 L5 of a slot 35→L4 of a slot 25→L3 of a slot
 17→L2 of a slot 7→L1 of a slot 53→L1 of a
 slot 45→L2 of a slot 53→L3 of a slot 9→L4 of
 a slot 17→L5 of a slot 27→L6 of a slot 35→L6
 of a slot 44→L5 of a slot 36→L4 of a slot 26→
 L3 of a slot 18→L2 of a slot 8→L1 of a slot 54;

a branch 1 of the W-phase winding, namely a
 first end W1 of W1-Z1, enters from the first layer
 L1 of a slot 13 of the winding along a current
 flow direction, finally flows out from a first layer
 L1 of a slot 24, and the winding connection se-
 quence is: L1 of a slot 13→L2 of a slot 21→L3
 of a slot 31→L4 of a slot 39→L5 of a slot 49→
 L6 of a slot 3→L6 of a slot 12→L5 of a slot 4→
 L4 of a slot 48→L3 of a slot 40→L2 of a slot
 30→L1 of a slot 22→L1 of a slot 14→L2 of a
 slot 22→L3 of a slot 32→L4 of a slot 40→L5
 of a slot 50→L6 of a slot 4→L6 of a slot 13→
 L5 of a slot 5→L4 of a slot 49→L3 of a slot 41→
 L2 of a slot 31→L1 of a slot 23→L1 of a slot
 15→L2 of a slot 23→L3 of a slot 33→L4 of a
 slot 41→L5 of a slot 51→L6 of a slot 5→L6 of
 a slot 14→L5 of a slot 6→L4 of a slot 50→L3
 of a slot 42→L2 of a slot 32→L1 of a slot 24;
 a branch 2 of the W-phase winding, namely a
 first end W2 of W2-Z2, enters from the first layer
 L1 of a slot 31 of the winding along a current
 flow direction, finally flows out from a first layer
 L1 of a slot 42, and the winding connection se-
 quence is: L1 of a slot 31→L2 of a slot 39→L3
 of a slot 49→L4 of a slot 3→L5 of a slot 13→
 L6 of a slot 21→L6 of a slot 30→L5 of a slot
 22→L4 of a slot 12→L3 of a slot 4→L2 of a
 slot 48→L1 of a slot 40→L1 of a slot 32→L2
 of a slot 40→L3 of a slot 50→L4 of a slot 4→
 L5 of a slot 14→L6 of a slot 22→L6 of a slot
 31→L5 of a slot 23→L4 of a slot 13→L3 of a
 slot 5→L2 of a slot 49→L1 of a slot 41→L1 of
 a slot 33→L2 of a slot 41→L3 of a slot 51→L4
 of a slot 5→L5 of a slot 15→L6 of a slot 23→
 L6 of a slot 32→L5 of a slot 24→L4 of a slot
 14→L3 of a slot 6→L2 of a slot 50→L1 of a
 slot 42;
 a branch 3 of the W-phase winding, namely a
 first end W3 of W3-Z3, enters from the first layer
 L1 of a slot 49 of the winding along a current
 flow direction, finally flows out from a first layer
 L1 of a slot 6, and the winding connection se-
 quence is: L1 of a slot 49→L2 of a slot 3→L3
 of a slot 13→L4 of a slot 21→L5 of a slot 31→
 L6 of a slot 39→L6 of a slot 48→L5 of a slot
 40→L4 of a slot 30→L3 of a slot 22→L2 of a
 slot 12→L1 of a slot 4→L1 of a slot 50→L2 of
 a slot 4→L3 of a slot 14→L4 of a slot 22→L5
 of a slot 32→L6 of a slot 40→L6 of a slot 49→
 L5 of a slot 41→L4 of a slot 31→L3 of a slot
 23→L2 of a slot 13→L1 of a slot 5→L1 of a
 slot 51→L2 of a slot 5→L3 of a slot 15→L4 of
 a slot 23→L5 of a slot 33→L6 of a slot 41→L6
 of a slot 50→L5 of a slot 42→L4 of a slot 32→
 L3 of a slot 24→L2 of a slot 14→L1 of a slot 6.

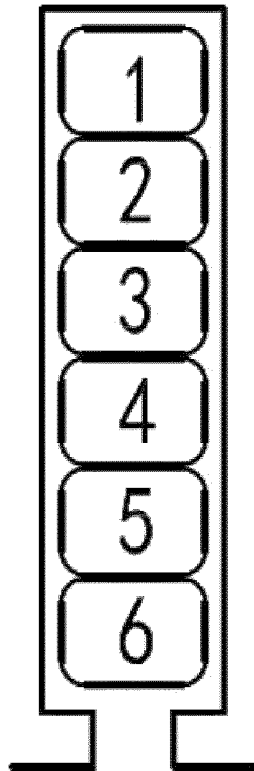


FIG. 1

slot layer	50	51	52	53	54	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-
2	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	V-	V-	V-	V-	U+	U+	U+	W-	W-
3	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-
4	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	V-	V-	V-	V-	U+	U+	U+	W-	W-
5	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-
6	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	V-	V-	V-	V-	U+	U+	U+	W-	W-

slot layer	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+
2	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+
3	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+
4	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+
5	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+
6	W-	V+	V+	V+	U-	U-	U-	W+	W+	W+	V-	V-	V-	U+	U+	U+	W-	W-	W-	V+	V+	V+	U-	U-	U-	W+	W+

FIG. 2

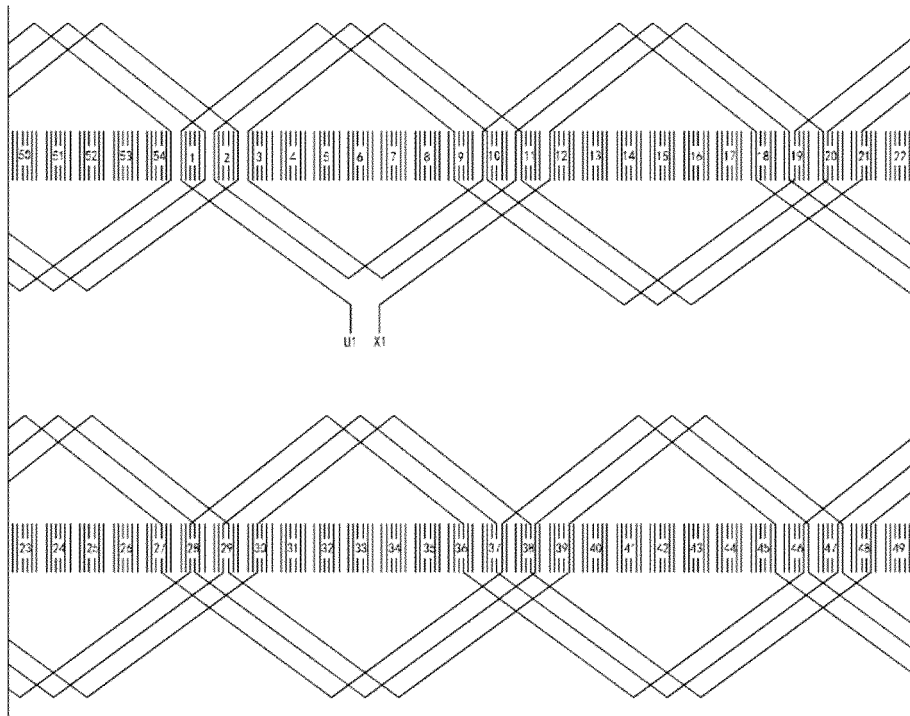


FIG. 3

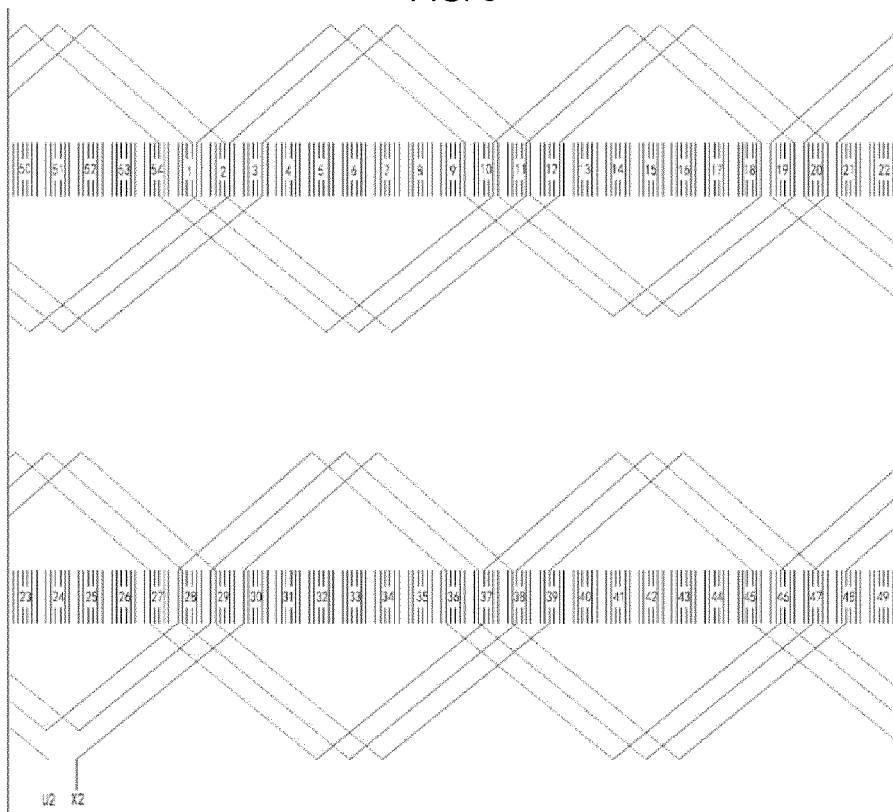


FIG. 4

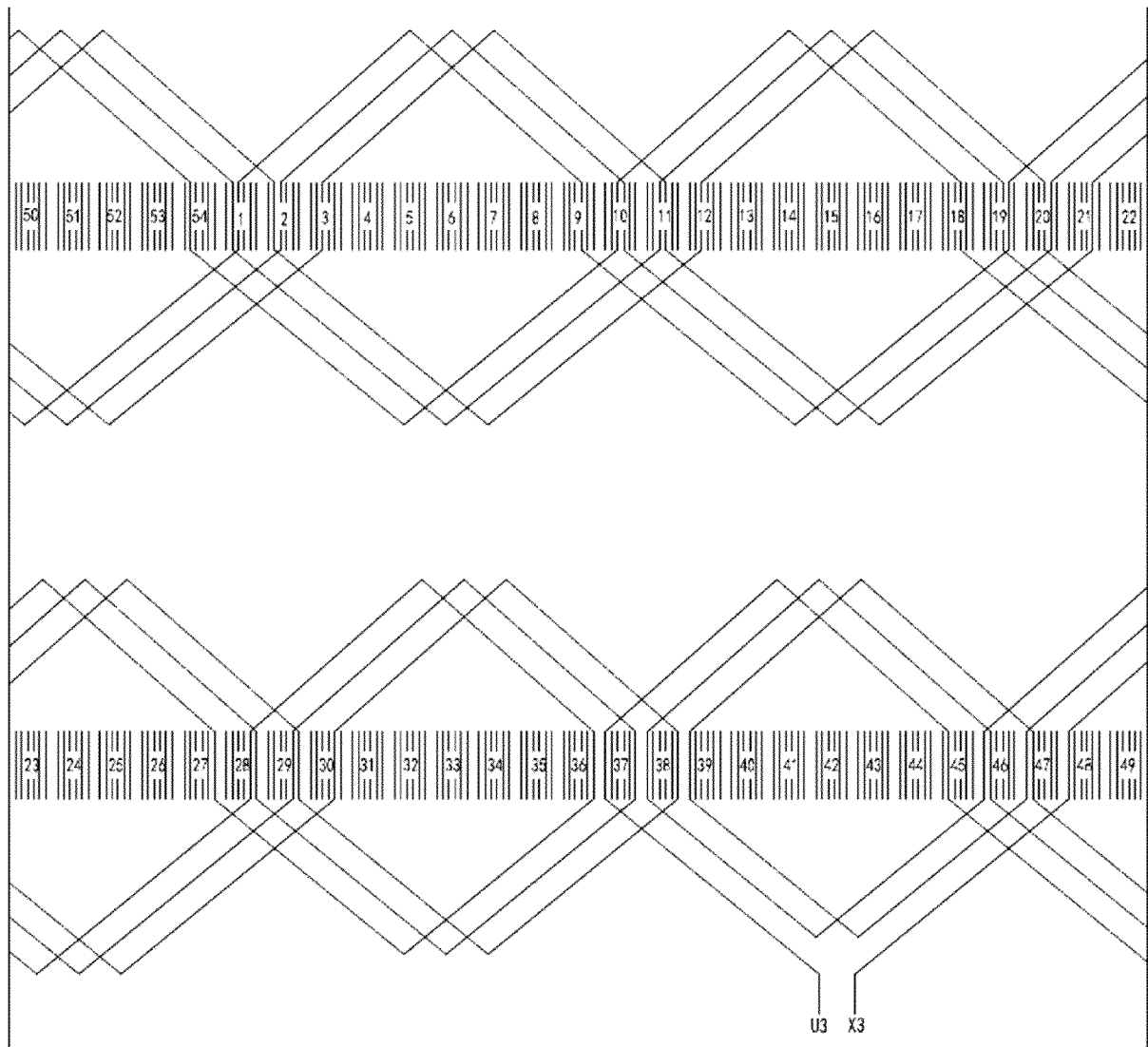


FIG. 5

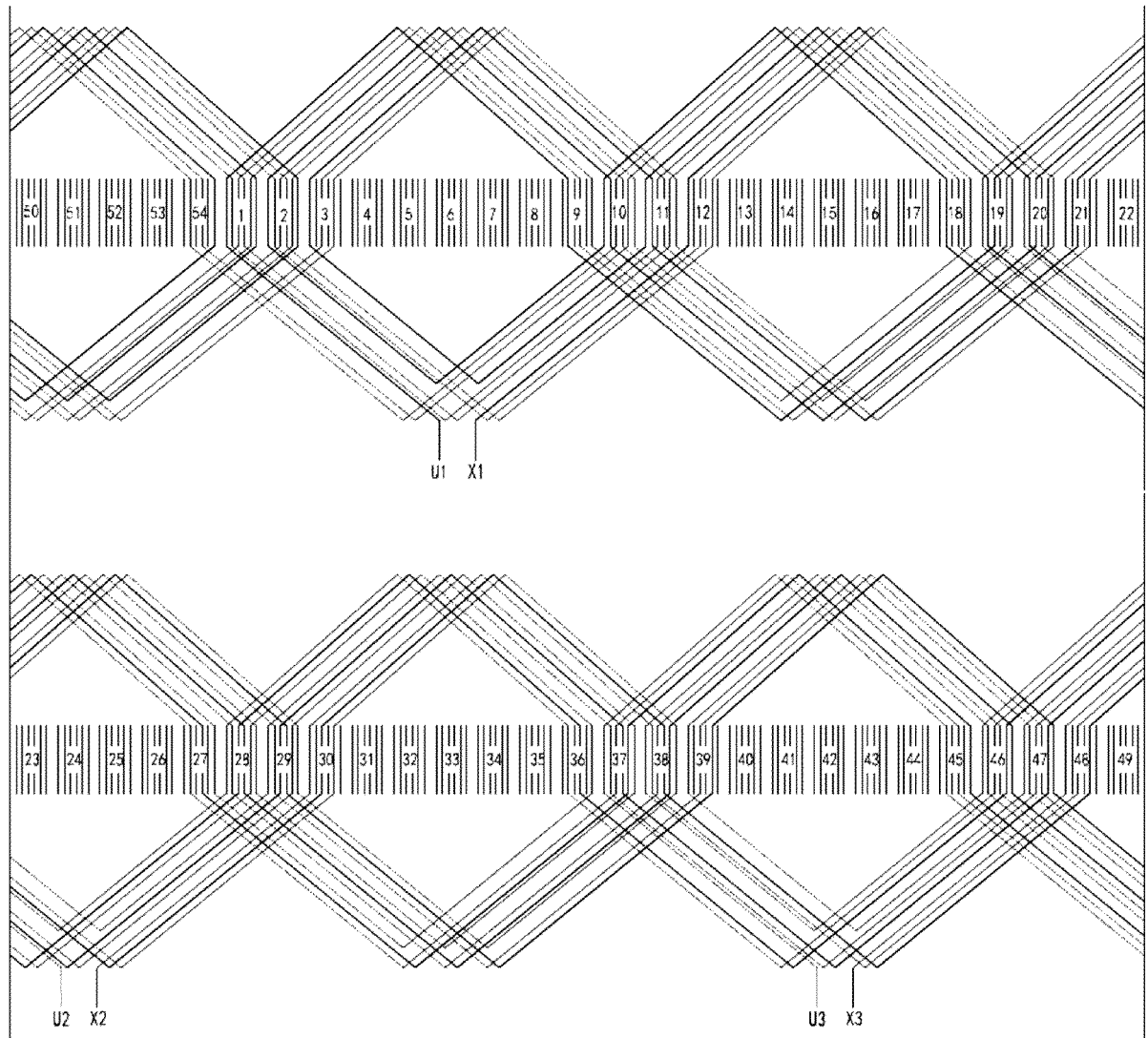


FIG. 6

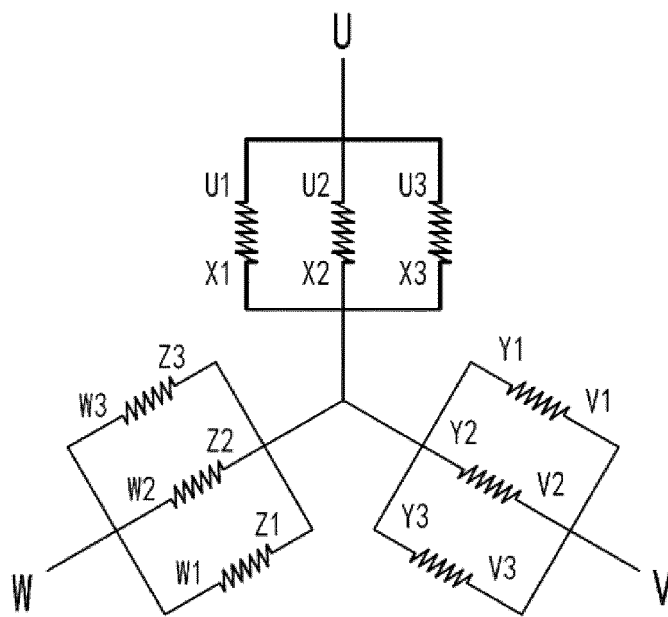


FIG. 7

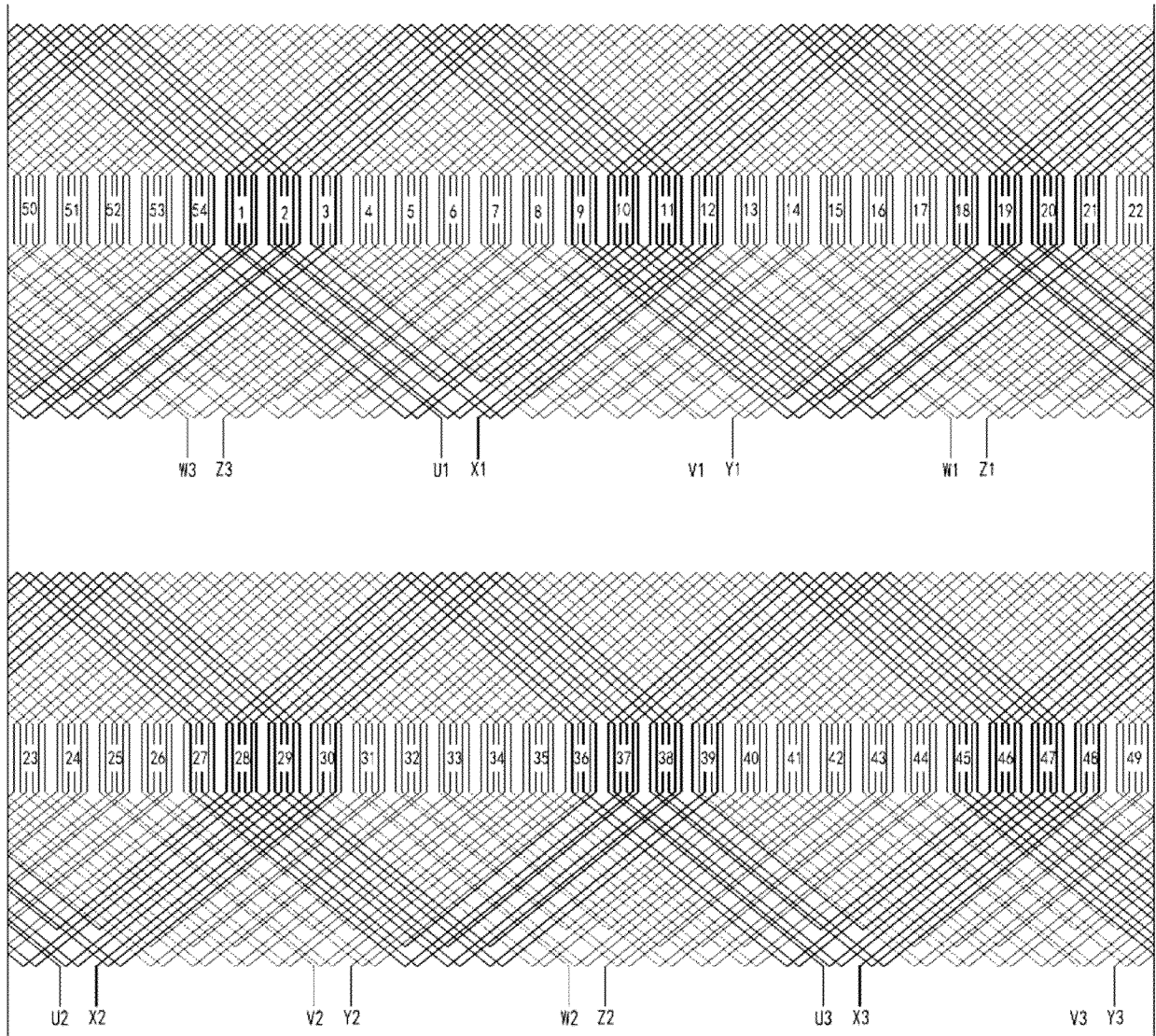


FIG. 8

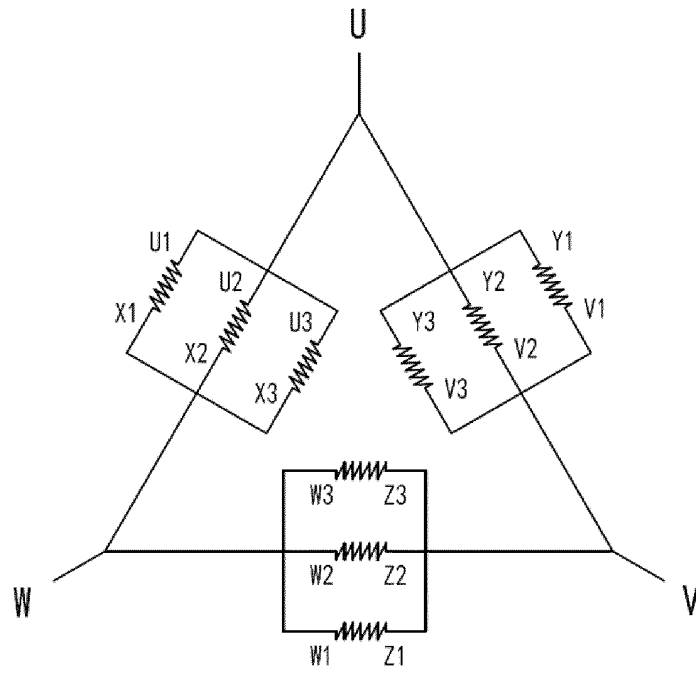


FIG. 9

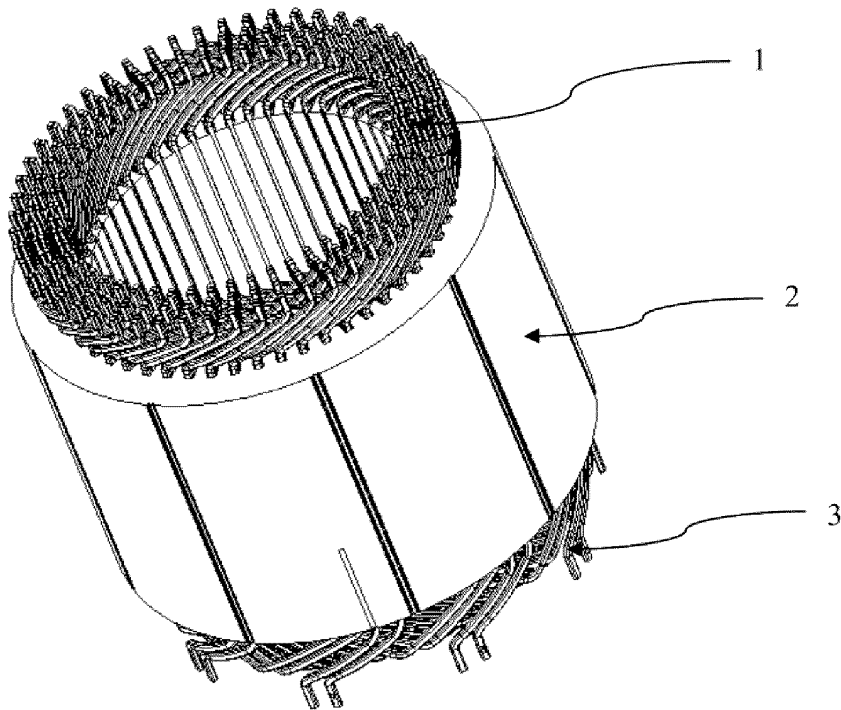


FIG. 10

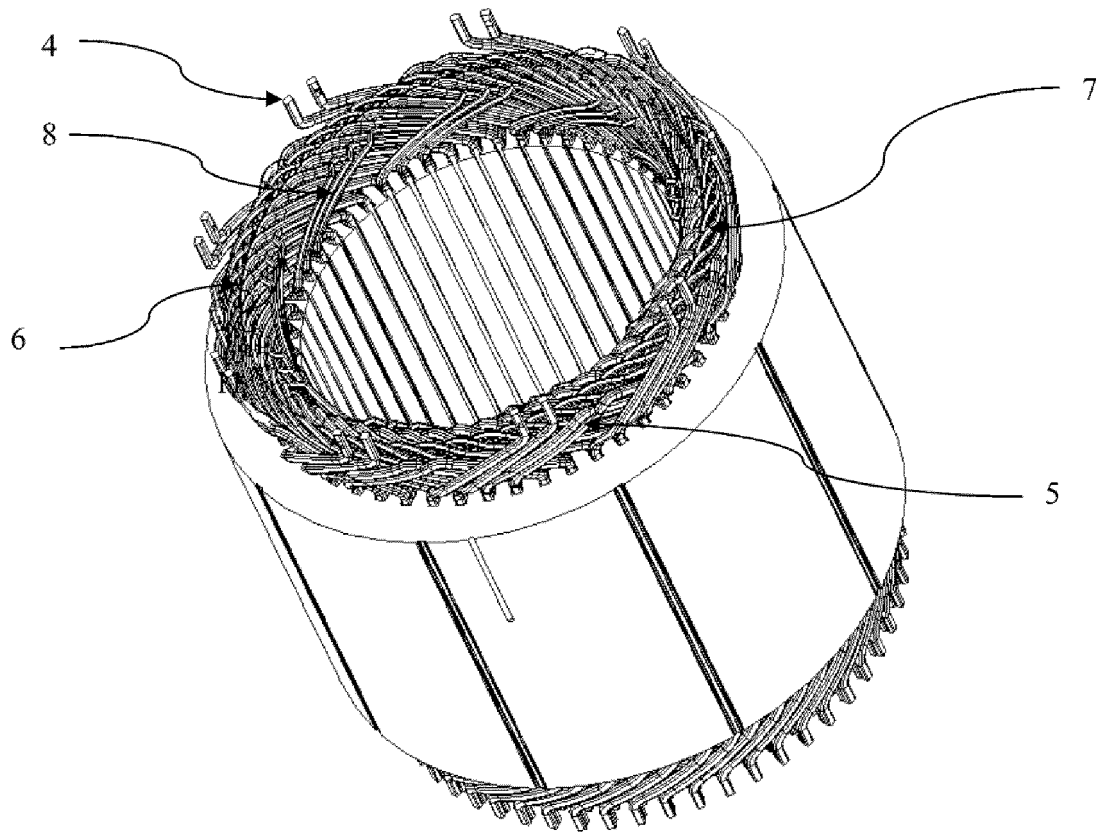


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/105417

A. CLASSIFICATION OF SUBJECT MATTER

H02K3/28(2006.01)i; H02K3/12(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT; VEN; VCN; ENTXTC; IEEE: 格至控智能动力, 支路, 平衡, 铁芯, 焊接, 跨距, 引出, 过桥线, 六极, 五十四, 槽, pole?, wire, three-branch, balanc+, weld+, outgoing, line

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 115395699 A (GEZHIKONG INTELLIGENT POWER TECHNOLOGY (SHANGHAI) CO., LTD.) 25 November 2022 (2022-11-25) description, paragraphs 14-24, claims 1-9, and figures 1-11	1-9
E	CN 219678223 U (GEZHIKONG INTELLIGENT POWER TECHNOLOGY (SHANGHAI) CO., LTD.) 12 September 2023 (2023-09-12) see description, paragraphs 41-60, claims 1-5, and figures 1-11	1-9
A	CN 209913599 U (SHANGHAI AUTOMOBILE GEAR WORKS CO., LTD.) 07 January 2020 (2020-01-07) entire document	1-9
A	US 2015076953 A1 (DENSO CORP.) 19 March 2015 (2015-03-19) entire document	1-9
A	WO 2021249346 A1 (TIANJIN SANTROLL AUTOMOTIVE COMPONENTS CO., LTD.) 16 December 2021 (2021-12-16) entire document	1-9

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

08 October 2023

Date of mailing of the international search report

17 October 2023

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
China No. 6, Xitucheng Road, Jimenqiao, Haidian District,
Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2023/105417

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 115395699 A	25 November 2022	None	
CN 219678223 U	12 September 2023	None	
CN 209913599 U	07 January 2020	None	
US 2015076953 A1	19 March 2015	US 9847686 B2	19 December 2017
		JP 2015084635 A	30 April 2015
		JP 5896250 B2	30 March 2016
WO 2021249346 A1	16 December 2021	CN 111555509 A	18 August 2020
		CN 212462901 U	02 February 2021

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202211135810 [0001]